

West Virginia University Libraries



3 0802 100663713 5

EVANSDALE LIBRARY
WEST VIRGINIA
UNIVERSITY

**Restricted
Circulation Only**

--	--	--



Agricultural Experiment Station

College of Agriculture, West Virginia University

N. J. Giddings, Acting Director
Morgantown

Certain Normal Characteristics of White Leghorn Females



By

HORACE ATWOOD

AGRICULTURAL EXPERIMENT STATION STAFF

FRANK BUTLER TROTTER, A. M., LL. D. President of the University
 N. J. GIDDINGS, Ph. D. Acting Dean and Director
 WALTER C. SCHNOPP, B. S. Agr. Agricultural Editor
 JOHN C. JOHNSTON Chief Clerk

AGRONOMY AND GENETICS

R. J. Garber, Ph. D.
 Agronomist and Geneticist
 E. P. Deatrick, Ph. D.
 Associate Agronomist (Soils)
 T. E. Odland, Ph. D.
 Associate Agronomist
 T. C. McIlvaine, Ph. D.†
 Assistant Agronomist (Soils)
 D. R. Dodd, M. S.
 Assistant Agronomist
 M. M. Hoover, M. S.
 Junior Agronomist
 H. K. Rowley, M. S. Agr.**
 Seed Analyst

ANIMAL HUSBANDRY

E. A. Livesay, M. S.
 Animal Husbandman
 Chas. V. Wilson, M. S.
 Assistant Animal Husbandman
 J. H. Longwell, M. A.
 Assistant Animal Husbandman
 J. H. Rietz, D. V. M.
 Associate Veterinarian
 R. H. Tuckwiller, B. S. Agr.*
 Assistant Animal Husbandman

CHEMISTRY

R. B. Dustman, Ph. D.
 Associate Chemist
 Chas. E. Weakley, Jr., B. A.
 Assistant Chemist
 L. P. Hansen, Ph. D.
 Assistant Chemist
 T. B. Leith, B. A.**
 Assistant Chemist
 Leland Shriver
 Assistant in Chemistry

DAIRY HUSBANDRY

E. L. Anthony, M. S. Agr.
 Dairy Husbandman
 H. O. Henderson, M. S. Agr.
 Associate Dairy Husbandman
 G. Malcolm Trout, M. S.
 Assistant Dairy Husbandman

ENTOMOLOGY

L. M. Pears, Ph. D.
 Entomologist
 W. E. Runsey, B. S.**
 State Entomologist
 L. E. Dills, M. S.**
 Assistant in Entomology

FARM ECONOMICS

A. J. Dadisman, Ph. D.
 Farm Economist
 Paul A. Eke, Ph. D.
 Assistant Farm Economist
 F. D. Cornell, Jr., M. S.
 Junior Farm Mechanic
 W. W. Armentrout, M. S.
 Junior Farm Economist

HOME ECONOMICS

Rachel H. Colwell, A. M.
 Home Economist
 Hazel C. Cameron, M. S.
 Research Specialist in Food
 Nell Nesbitt, A. M.
 Research Specialist in Home Management

HORTICULTURE

H. E. Knowlton, Ph. D.
 Associate Horticulturist
 H. L. Crane, M. S. Agr.
 Associate Horticulturist
 K. C. Westover, M. S. Agr.
 Assistant Horticulturist
 Ernest Angelo, M. S. Agr.
 Junior Horticulturist
 L. F. Sutton, B. S. Agr.‡
 Assistant Horticulturist
 H. P. Sevy, M. S. Agr.
 Assistant in Horticulture
 M. B. Hoffman, M. S.
 Assistant in Horticulture

PLANT PATHOLOGY

N. J. Giddings, Ph. D.
 Plant Pathologist
 Anthony Berg, M. S.
 Associate Plant Pathologist
 L. H. Leonian, Ph. D.
 Associate Plant Pathologist
 E. C. Sherwood, M. S.
 Assistant Plant Pathologist

POULTRY HUSBANDRY

Horace Atwood, M. S. Agr.
 Poultry Husbandman
 E. T. Wightman, M. S. Agr.
 Junior Poultry Husbandman

RURAL SOCIOLOGY

T. L. Harris, Ph. D.
 Rural Sociologist

ZOOLOGY

F. E. Chidester, Ph. D.
 Zoologist

*In cooperation with the U. S. Department of Agriculture, Washington, D. C.

†In charge of the Lakin Sub-station, Lakin, W. Va.

**In cooperation with the State Department of Agriculture, Charleston, W. Va.

‡In charge of the Reymann Memorial Farms, Wardensville, W. Va.

*A Study of Certain Normal Characteristics of White Leghorn Females**

[PROGRESS REPORT]

In the development and improvement of the different breeds of poultry it is of first importance to have definite knowledge concerning the relationships between the different characteristics of the birds, for without this knowledge no intelligent program can be adopted. A breeder may need to know how he should proceed to decrease the variation in the size of the eggs laid by his fowls, or to increase or decrease the average size of the eggs, if that should be desirable. It is possible that problems of this nature can be more quickly and easily approached through a study of the normal relationships of the characteristics in the fowls than in any other way.

BIRDS USED AND GENERAL PLAN OF EXPERIMENT

The strain of Single Comb White Leghorns which was selected for this experiment had not been systematically bred so as to affect either the number, the size, or the variability in the size of the eggs laid. In fact, the fowls might well be considered a random sample of improved White Leghorns.

The general plan of the experiment was to select 200 pullets of this strain, feed them a laying ration which would be uniform during the course of the experiment, and keep a record during the life of the birds of their weight, the number of eggs laid, the weight of each egg, the date of laying, and the amount and kind of feed consumed by the birds per month. These data properly analyzed should afford information on the following points:

- 1.—The amount of variation in the mean or average weight of the different birds.
- 2.—The changes in the weight of laying hens from month to month and from year to year.
- 3.—The relationship between body weight and mean egg weight. In other words, the relationship, if any, between the size of the bird and the size of the eggs that she lays.
- 4.—The relationship between the size of the bird and the number of eggs that she lays.

* Submitted for publication March, 1927.

5.—The relationship, if any, between the size of the eggs and the number which a bird may lay.

6.—The relationship between the variations in the weight of the eggs which a bird lays and the number which she lays.

7.—The relationship between early sexual maturity and fecundity.

8.—The effect that the age of the bird has on the total annual weight of the eggs that she lays.

9.—The relationship, if any, between the mean decrease in the weight of the eggs in the cycles and the annual production.

This experiment was started November 1, 1925, when 200 Single Comb White Leghorn pullets were placed in small colony laying house. The birds were hatched June 15 and had free range until they were placed in their winter quarters at which time their average weight was 2.62 pounds. This report covers the first year of the experiment.

General Directions

The following directions were adopted for carrying on the experiment.

GUIDE FOR WEIGHING AND FEEDING

1.—*Weighing Fowls*: Fowls to be weighed on the first day of each month. Weighing to be done early in the morning before the fowls are fed and the weight recorded to one-tenth pound.

2.—*Weighing Feed*: A record is to be kept of the total amount of feed consumed during each calendar month.

3.—*Weighing Eggs*: Eggs are to be weighed during the forenoon following the day on which they were laid. Weights to be recorded to one-tenth gram.

4.—*Feeding the Fowls*: Fowls are to be fed dry mash in hoppers and scratch feed in straw litter. Both the dry mash and the scratch feed are to be thoroughly mixed. The mash is to have the following composition:

Ingredients	Pounds
Bone Meal.....	50
Yellow Corn Meal (ground corn).....	200
Ground Oats.....	100
Wheat Middlings, 16½% protein.....	200
Meat Scrap, 50% protein.....	75
Salt	6
Powdered Buttermilk.....	75

The scratch feed is to have the following composition:

Ingredients	Pounds
Yellow Corn.....	200
Wheat	100
Clipped Oats.....	100

Germinated Oats are to be fed during December, January, February, and March at the rate of 2 pounds dry oats per 100 fowls, per day. Cryster shell and limestone grit are to be given ad libitum.

The scratch feed is to be fed throughout the year at the following rates:

November	12 pounds per 100 fowls
December	12 pounds per 100 fowls
January	12 pounds per 100 fowls
February	12 pounds per 100 fowls
March	12 pounds per 100 fowls
April	10 pounds per 100 fowls
May	10 pounds per 100 fowls
June	8 pounds per 100 fowls
July	6 pounds per 100 fowls
August	6 pounds per 100 fowls
September	5 pounds per 100 fowls
October	5 pounds per 100 fowls

Broody Hens and Moulting: All broody hens are to be broken up as promptly as possible, and a record is to be kept of the individuals that become broody, length of time broody, the beginning of moult for each individual, and the length of moult.

Health of the Fowls

The health of the fowls during the year was good. There were twelve mortalities. Six birds were killed by dogs, accidents accounted for four more, and two deaths were attributed to weakness or disease. The following discussion of the results is based on the records made of the 188 birds remaining at the end of the year.

Weight of Birds

Table 1 gives the mean weight of the 188 birds on the first day of each month, the standard deviation in their weight, and the coefficient of variability.

TABLE 1.—Mean Weights of the Pullets Each Month, Standard Deviations Their Weights, and Coefficients of Variability in Weights, From November, 1925, to October, 1926.

Months	Mean Weights in Pounds	Standard Deviations in Weights	Coefficients of Variability
November.....	2.62±.011	.224±.008	8.55±.30
December.....	3.08±.016	.328±.011	10.65±.37
January.....	3.34±.015	.303±.011	9.07±.32
February.....	3.37±.016	.335±.012	9.94±.35
March.....	3.49±.016	.329±.011	9.43±.33
April.....	3.47±.015	.307±.011	8.85±.31
May.....	3.57±.016	.318±.011	8.91±.31
June.....	3.67±.018	.369±.013	10.05±.35
July.....	3.68±.018	.365±.013	9.91±.34
August.....	3.70±.020	.409±.013	11.05±.38
September.....	3.75±.020	.411±.014	10.96±.38
October.....	3.76±.023	.476±.017	12.66±.44

From Table 1 it may be seen that the increase in the weight of the birds was relatively rapid during November and December. In January there was no significant increase; in February there was a slight gain; in March no significant change; but in April and May there was some further increase. During the remainder of the year the increase in weight was slight.

The standard deviation in the weight of the different birds increased considerably during the month of November. From the first of December till the first of May there was little change in the deviation in weight of the birds, but later in the season the variability in the weight of the birds increased slightly. If it should be shown, as now appears probable, that there is a significant positive correlation between the size of a bird and the mean weight of the eggs that she lays, then the deviation in the weight of a flock of pullets in the fall could be used as a measure of the variability in the weight of the eggs that they would lay later in the season. Hence, by selecting pullets of a uniform weight the variability in the egg weight would be kept at a minimum for any particular strain.

Table 2 gives the average weight of each bird based on the twelve weighings of each individual, and the number and average weight of the eggs laid by each bird.

TABLE 2.—Average Weights of the 188 Birds That Finished the First Year of the Test, Number of Eggs Laid, and Average Weight of the Eggs Laid by Each Bird.

Band Numbers of Birds	Average Weights in Pounds	Number of Eggs Laid	Average Weights in Grams
2	4.37	15	57.9
3	3.63	224	55.9
5	3.07	153	52.5
6	3.46	208	53.7
7	3.31	129	46.9
8	3.25	142	51.2
9	4.21	161	56.8
10	3.44	173	54.5
11	3.33	182	51.3
12	3.34	124	49.6
13	3.53	127	58.2
14	3.13	193	52.4
15	3.73	161	51.3
16	3.93	163	61.8
17	3.41	205	46.7
18	3.88	175	55.2
19	3.73	150	53.8
20	3.11	170	51.3
21	3.51	164	47.8
22	3.54	156	52.0
23	3.21	207	51.9
24	3.51	173	53.7
25	3.52	200	53.8
26	3.87	125	60.0
27	3.33	200	50.4
28	3.49	193	50.3
29	3.60	140	49.9
30	3.54	183	50.1
31	3.44	176	54.2
32	3.52	104	60.6
33	3.52	213	52.4
34	3.78	155	60.1
35	3.50	182	55.2
36	3.45	155	57.1
37	3.25	140	61.9
38	3.64	156	56.3
39	3.51	107	54.5
40	3.72	209	50.5
41	3.53	154	53.2
42	3.39	158	50.7
43	3.29	118	57.2
44	3.77	240	50.0
45	3.76	178	52.2
46	3.49	161	53.5
48	3.37	177	52.5
49	4.01	158	54.1
50	3.48	153	55.3

(Continued)

TABLE 2—Continued.

Band Numbers of Birds	Average Weights in Pounds	Number of Eggs Laid	Average Weights in Grams
51	3.31	205	49.9
52	4.09	186	59.1
53	3.90	211	50.8
54	3.48	206	58.1
56	3.16	157	54.1
57	3.83	147	53.9
58	3.83	105	56.9
59	3.48	148	51.3
60	3.32	163	49.3
61	3.90	173	56.2
62	3.46	195	56.8
63	3.92	26	59.5
64	3.88	194	54.4
65	3.47	213	54.5
66	3.33	208	48.7
67	3.43	227	52.4
68	3.35	120	56.0
69	3.41	176	53.3
70	3.70	182	50.6
71	3.92	225	56.5
72	3.62	56	50.2
73	3.58	182	56.0
74	3.64	215	54.6
75	3.81	224	53.3
76	3.54	48	49.5
77	3.18	203	49.6
78	2.95	36	48.0
79	3.76	170	55.9
80	3.04	195	51.1
81	3.46	149	55.3
82	3.47	216	55.2
83	3.27	255	50.3
84	3.20	227	51.2
85	3.63	165	59.6
86	3.28	123	56.0
87	3.37	168	55.1
88	3.05	188	53.2
89	3.48	206	52.9
90	3.36	150	53.5
91	3.47	167	53.5
92	3.21	166	52.7
93	3.41	181	54.0
94	3.48	190	57.5
96	3.89	208	60.2
97	4.07	170	51.9
98	3.43	184	54.7
100	3.30	189	55.0
101	3.27	204	52.4
102	3.53	54	55.2
103	3.46	123	53.8
104	3.08	182	49.7
106	3.49	173	58.4
107	3.39	124	53.4
108	3.48	213	50.3
109	3.80	233	51.7
110	3.60	202	55.7

(Continued)

TABLE 2—Continued.

Band Numbers of Birds	Average Weights in Pounds	Number of Eggs Laid	Average Weights in Grams
111	3.77	113	61.8
112	3.25	219	49.2
113	3.15	181	52.9
114	3.00	186	52.8
115	3.40	196	55.2
116	3.69	155	53.1
117	3.35	113	49.6
118	3.08	172	50.0
119	3.53	191	58.1
120	3.82	169	54.8
121	3.29	166	55.0
122	3.41	176	54.6
123	3.78	213	59.9
121	3.41	199	53.6
125	2.97	143	54.8
126	2.84	236	47.1
127	3.25	221	47.7
128	3.83	102	56.9
129	3.38	182	51.6
130	3.40	203	52.0
131	2.99	204	51.9
132	2.87	207	49.9
133	3.13	134	51.6
134	3.41	201	56.0
135	3.60	201	54.8
136	3.66	227	53.7
137	3.68	140	53.5
138	3.16	190	53.7
139	3.72	99	52.9
119	3.28	169	49.4
111	3.87	137	54.4
112	3.48	18	51.0
113	4.09	173	53.6
144	3.95	178	50.1
145	3.77	118	57.8
146	3.26	195	50.5
147	3.59	175	56.6
148	3.44	188	54.2
149	3.73	163	56.6
150	3.19	212	46.3
151	3.49	179	56.8
152	3.55	176	47.7
154	3.16	196	51.1
155	3.45	113	51.4
156	3.81	189	56.5
157	3.64	171	52.1
158	3.40	143	52.6
159	3.78	194	47.8
160	3.15	166	48.0
161	3.51	140	52.3
162	3.27	145	54.3
163	3.05	157	44.9
164	3.73	172	49.2
165	3.02	150	47.6
166	2.97	113	47.0
167	3.33	185	52.9

(Continued)

TABLE 2—Concluded.

Band Numbers of Birds	Average Weights in Pounds	Number of Eggs Laid	Average Weights in Grams
168	3.14	169	53.1
169	2.93	140	48.6
170	3.60	195	54.2
171	3.08	109	50.2
172	3.41	141	53.0
173	3.43	158	53.6
174	3.02	182	51.2
175	3.48	228	50.1
176	3.93	168	57.5
177	3.31	170	53.0
178	3.17	181	54.7
179	3.56	207	54.8
180	3.10	166	50.9
181	3.17	216	52.8
182	3.60	140	54.1
184	3.24	220	54.6
185	3.43	110	51.8
186	3.47	199	55.6
187	3.21	149	45.8
190	3.37	126	54.3
191	3.20	157	54.8
192	3.56	230	49.8
193	3.30	125	54.5
194	3.10	189	49.7
195	3.60	161	53.8
196	3.00	180	53.0
197	3.38	230	52.9
198	3.42	183	55.5
200	3.28	143	57.6

The mean weight of the birds, based on the average weight each individual, was $3.46 \pm .013$ pounds; the standard deviation of the average weights of the birds was $.274 \pm .010$; and the coefficient of variability was $7.92 \pm .27$. These figures probably represent with fair degree of accuracy the variability in weight of an unselected strain of White Leghorn pullets.

The total number of eggs laid by the 188 birds was 31,682. For five birds laid 200 or more eggs each, while only eight birds laid fewer than 100 eggs each. The production ranged from a maximum of 228 eggs in the case of bird 83 to a minimum of 15 for bird 2. The average egg weight varied from a maximum of 61.9 grams for bird 37 to a minimum of 44.9 grams for bird 163. The average weight of all the eggs laid during the year by the 188 birds, including the eggs (4.6%) laid outside the trap nests, was 53.09 grams.

Due to the immaturity of the pullets the production during the winter months was low as shown in Table 3, but with the beginning of spring the production materially increased, reaching a maximum in May with an average daily production of 144.13 eggs from 188 birds.

TABLE 3.—Number of Eggs Laid During Each Calendar Month by the 188 Birds, Average Weight of Eggs, Average Number of Eggs Laid Daily, and the Average Number Laid per Bird per Month, From November, 1925, to October, 1926.

Months	Total Number of Eggs Laid	Average Weights of Eggs in Grams	Average Number of Eggs Laid Daily	Average Number Eggs Laid Per Bird Per Month
November.....	71	39.23	2.37	.38
December.....	1148	42.80	37.03	6.11
January.....	1397	46.58	45.06	7.44
February.....	1402	49.66	50.07	7.46
March.....	3323	51.96	107.19	17.68
April.....	4159	53.56	138.63	22.12
May.....	4468	53.39	144.13	23.77
June.....	4014	54.08	133.80	21.35
July.....	3928	54.13	126.71	20.89
August.....	3646	54.45	117.61	19.39
September.....	2646	56.17	88.20	14.07
October.....	1480	57.28	47.74	7.87

production of 76.7 percent. The average production per bird in the year was 168.52 eggs, which is reasonably good for a strain of birds that had not been bred for high fecundity.

With a very slight exception in the month of May, the average egg weight increased from the beginning of the laying year to its end. This increase was especially great during December, January, February, March, and April. During the next four months there was but little change, but during the last two months the eggs increased in weight on an average of more than one gram each.

If eggs weighing two ounces each, or about 56 grams, are most desirable for commercial purposes, then the eggs laid by this flock were much too light during the first half of the laying year, and the problem of how to increase the average size of the eggs laid by pullets during the fall and early winter months without materially increasing egg size later in the season is worthy of careful study.

It is desirable to produce eggs of uniform size, hence it is important to know the degree of variability in the weight of the eggs laid by the birds in an unselected strain. This variability expressed as the standard deviation in the average annual egg weights for the 188 females amounts to 3.30 ± 1.11 grams, with a coefficient of variability of 6.2 percent. This standard deviation in the average egg weights corresponds closely with the figures reported by the author in Bulletin 195 of the Poultry Station.

The relationship between the size of a fowl and the size of the eggs it lays is important, for, if such relationship does exist, it affords the poultryman an easy and direct method of quickly modifying the

size of the eggs should this be desirable to meet market requirements. To throw some light on this condition, the coefficient of correlation has been calculated, using the average body weight and average egg weight of the 188 birds under discussion. The coefficient thus derived is $+0.459 \pm 0.039$. This is clearly significant as the coefficient is almost twelve times the probable error. These results agree with those shown by the author in Bulletin 195, and the conclusion seems justified that the heavier birds in a flock lay the heavier eggs.

The relationship between the number of eggs that a bird will produce is dependent on whether they are large or small is also important to the producer.

The coefficient of correlation between the number of eggs laid by the different birds and the average weight of the eggs laid by the same birds is -0.136 ± 0.048 . As this coefficient is less than three times the probable error, the evidence indicates that there is no relation between the number of eggs laid by a bird and the average size of the eggs. This result, too, is in agreement with the earlier findings of the author reported in bulletins 182 and 195 of this Station.

In breeding to increase the egg production of a flock, it is equally as important to decrease the number of very poor layers as it is to increase the production of the better layers, hence it is of value to have data on an unselected strain showing what may be designated as the normal variability in respect to the number of eggs laid by various females. The standard deviation in the number of eggs laid has been calculated and has been found to be 41.52 ± 1.44 . This is a high deviation and shows that there was a very material variability in the number of eggs laid by the birds in the flock.

As to whether the heavier birds of this flock laid as many eggs as their smaller companions, the coefficient of correlation between the weight of the birds and the number of eggs laid has been found to be -0.159 ± 0.047 . This coefficient is not significant, as it is only about three times its probable error, and consequently as far as these data go the smaller birds of this flock laid equally as well as the larger ones.

The pullets that develop fastest during the summer and lay first in the fall should have a better opportunity to make a good egg record during the first laying year than their companions that begin to lay later in the season. It is possible, nevertheless, that the birds that develop more slowly will lay more steadily after they begin to lay and hence make as good or better records than those that begin to lay earlier in the season. In order to study this matter the coefficient

relation was calculated between the age in days when each female laid her first egg and the number of eggs laid during the first year by each bird, and found to be $-.403 \pm .041$. This coefficient is significant as it is about ten times its probable error and is negative. In other words, the older the pullet before beginning to lay the fewer eggs did she lay during the first laying season. This relationship gives the poultryman an easy and reliable method of culling his pullets in the fall so as to increase the egg production during the first laying year. Whether this relationship holds true during succeeding years remains for future experiments to determine.

The mean age of laying the first egg was 198.05 ± 1.69 days and varied from a minimum of 152 days to a maximum of 310 days. The standard deviation of the age of the birds in days when they laid the first egg was 34.4 days. This deviation is considerably larger than that reported by the author in Bulletin 182, for White Leghorn pullets. This large deviation is probably due to the fact that the birds in this experiment were late hatched and those that were somewhat backward about starting to lay in the fall were delayed by the cold weather of winter so that they did not begin to lay until the advent of spring, thus materially increasing the deviation in the age of laying.

It appears that the standard deviation in the age of laying the first egg is a very valuable criterion by which to determine the success of breeding and management. In a flock of pullets properly bred and properly reared, all the birds should begin to lay at about the same time in the fall thus giving evidence of uniformity in breeding and development.

To throw light on the question as to whether or not the heavier birds mature at a younger age and begin to lay earlier in life than the smaller companions, the coefficient of correlation between the average weight of each bird and her age in days when laying her first egg was calculated, and found to be $+.003 \pm .049$. As this coefficient is not significant, being only one-fifteenth as great as its probable error, the evidence indicates that there is no relation between the size of the bird and the age at which she begins to lay.

Tables 1 and 3 show that there was a progressive increase in the weight of the birds and also a similar increase in the weight of the eggs from month to month. The coefficient of correlation between the monthly weight of the birds and the monthly weight of the eggs was calculated and found to be $+.996 \pm .013$, showing that the increase in body weight and the increase in egg weight go closely hand

in hand, at least during the pullet year. This relationship is also shown clearly by Figures 1 and 2. Figure 3 shows the mean egg production for each month of the year.

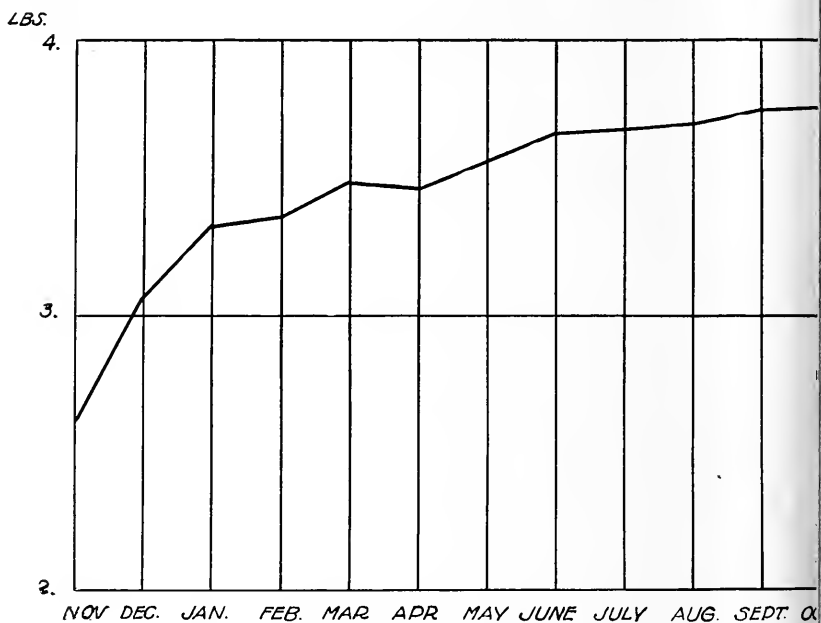


Fig. 1—Mean monthly weights of birds.

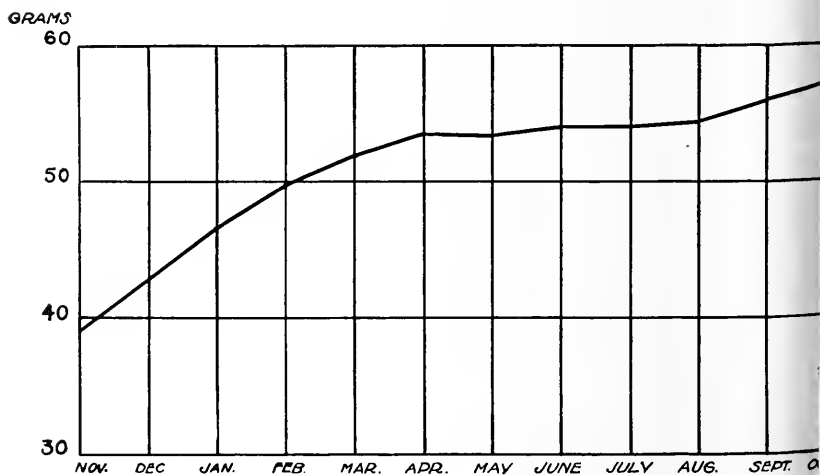


Fig. 2—Mean monthly weights of eggs.

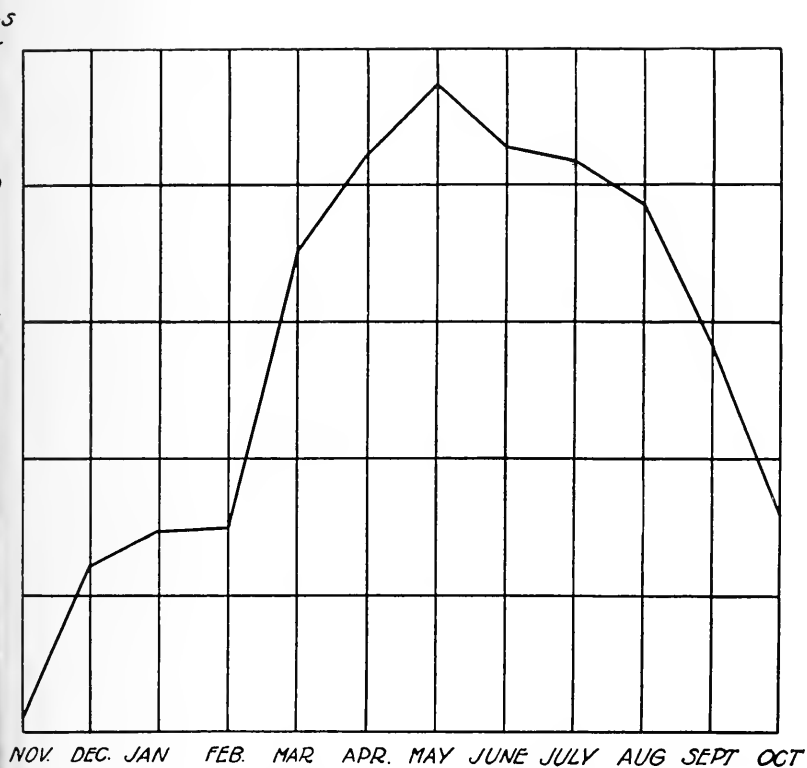


Fig. 3—Mean egg production per month.

SUMMARY

In this bulletin is discussed the record of 188 Single Comb White Leghorn pullets during their first laying year, or from October 1, 1925, to November 1, 1926.

During the year all of the eggs that were laid were weighed individually and the weight recorded to one-tenth gram. Each bird was also weighed monthly.

1.—The average weight of the different birds ranged from a minimum of 2.84 pounds to a maximum of 4.37 pounds. The mean weight of the birds at the beginning of the year was 2.62 and at its close 3.76 pounds.

2.—The egg production ranged from a minimum of 15 eggs to a maximum of 255. The average production for the year was 168.8 eggs. Eight birds laid fewer than 100 eggs each, while forty-five laid 200 or more.

3.—The average weight of the eggs laid by the different birds ranged from a minimum of 44.9 grams to a maximum of 61.9 grams. The mean weight of all eggs laid during the year was 53.09 grams.

4.—Based on the eggs laid in the trap nests, forty-seven birds each laid during the year a total weight of ten thousand grams or more eggs.

5.—With but slight exceptions, the average size of the eggs increased from the beginning of the year to its close.

6.—The heavier birds laid the heavier eggs.

7.—There was no relation between the number of eggs laid by a bird and the size of the eggs.

8.—There was no relation between the size of the bird and the number of eggs that she laid.

9.—The birds that were youngest when beginning to lay laid more eggs during the first year than did their companions that matured more slowly.

10.—There was no relation between the average size of a bird and her age when reaching sexual maturity.

11.—The increase in the weight of the birds and the increase in the mean weight of the eggs were closely related throughout the year.

HECKMAN
BINDERY INC.



JUNE 99

Bound -To -Please® N. MANCHESTER,
INDIANA 46962

